# Resistance to the Soybean Aphid (Homoptera: Aphididae) in Soybean

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## Introduction

- Since its arrival in North America around 2000, the soybean aphid, *Aphis glycines* Matsumura, has become established as one of the most important insect pests of soybean, *Glycine max* (L.) Merrill.
- Over the last few years, researchers at the University of Illinois discovered sources of aphid resistance, characterized resistance expression, determined the inheritance of resistance, mapped resistance genes, and identified soybean aphid biotypes.
- This poster summarizes some of that work.

## Germplasm evaluation

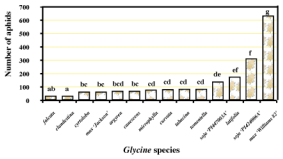
**Summary of screening for resistance to *A. glycines* in soybean germplasm**

| Germplasm | Number tested | Number resistant* |
|---|---|---|
| Commercial cultivars (MG II, II, IV) | 818 | 0 |
| Asian cultivars | 106 | 0 |
| Pubescent lines | 11 | 0 |
| Ancestral lines | 101 | 9 |
| Diverse collection of germplasm accessions | 3000 | 87 |

*Soybean aphid biotype 1

## Soybean allies & other legumes

Number of aphids on accessions of different *Glycine* species 21 days after exposure to soybean aphid biotype 1 alatae in a non-choice test



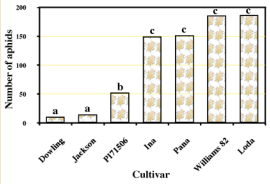

*A. glycines* colonization on wild soybean and other legumes

- *Glycine* species were the best hosts
- Accessions of *Medicago*, *Phaseolus*, *Trifolium*, *Onobrychis*, and *Vigna* species supported limited colonization
- Accessions of *Lens*, *Lotus*, *Pisum*, and *Vicia* species were non-hosts

## Resistance evaluation

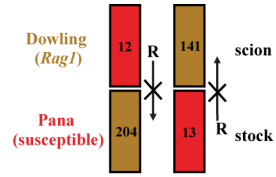
### Choice tests


Number of aphids on resistant and susceptible genotypes 9 days after exposure to alatae during the $V_1$ growth stage in a choice test*




*Soybean aphid biotype 1

**Number of aphids 12 days after inoculation with two apterous adults***

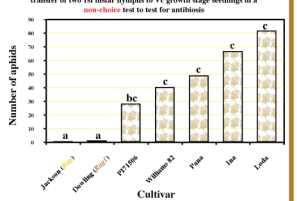



Resistance was not graft-translocated

*Soybean aphid biotype 1

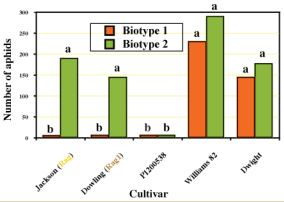

### Non-choice tests

Number of aphids* on resistant and susceptible genotypes 12 days after transfer of two 1st instar nymphs to Vc growth stage seedlings in a non-choice test to test for antibiosis

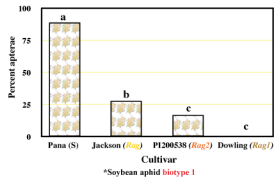



*Soybean aphid biotype 1

Number of aphids on resistant and susceptible genotypes 10 days after transfer of two 1st instar nymphs to Vc growth stage seedlings in a non-choice test to test for antibiosis




Percent of viviparous apterae* remaining on the leaves of three resistant and one susceptible cultivar 48 h after transfer




*Soybean aphid biotype 1

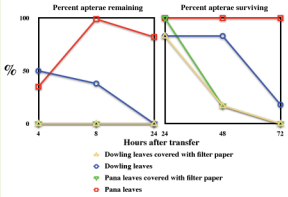
## Resistance expression

*Results of experiments with soybean aphid biotype 1

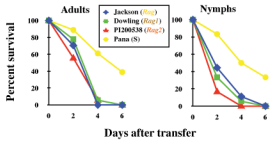
**Antibiosis effects on *A. glycines***

- Antibiosis resulted in significant reductions in:
  - fecundity
  - percent of 1st instar nymphs that mature to adulthood
  - adult life span
  - survival of both nymphs and adults.
- Dowling had strong antixenosis in addition to antibiosis.
- Starvation was not the main cause of reduced aphid survival on Dowling.

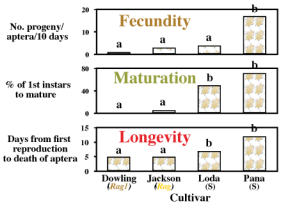
Behavior of viviparous apterae placed on leaves of Dowling and Pana or leaves covered with filter paper



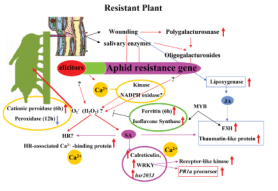

Survival of *A. glycines* adults and nymphs on a susceptible and three resistant soybean cultivars




Effects of antibiosis resistance on *A. glycines* biology

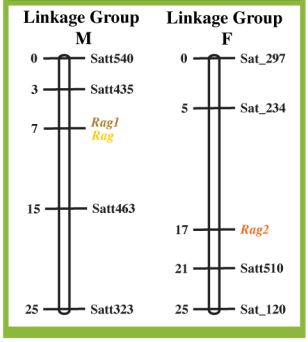



Soybean genes responding to *A. glycines* attack




## Soybean resistance genes

| Germplasm source | Type of resistance | Inheritance | Resistance gene |
|---|---|---|---|
| Dowling | antibiosis | simple & qualitative | *Rag1* |
| Jackson | antibiosis | simple & qualitative | *Rag* |
| PI200538 | antibiosis | simple & qualitative | *Rag2* |
| PI71506 | antixenosis | complex & quantitative | two or more QTLs |




## Soybean aphid biotypes

| Biotype | Williams 82 | *Rag1* | *Rag2* |
|---|---|---|---|
| 1 | + | - | - |
| 2 | + | + | - |
| 3 | + | - | + |
| 4 | + | + | + |

+ = compatible - = incompatible

## References

Hill, C. B., Y. Li, and G. L. Hartman. 2004. Resistance to the soybean aphid in soybean germplasm. Crop Science 44: 98-106.

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